

LISTING OF CLAIMS

Claim 1-50 (Cancelled)

Claim 51 (Currently Amended): The catalytic system as claimed in claim 46 97, wherein the nickel compound (B₁) is selected from:

- bis(1,5-cyclooctadiene)nickel(0);
- bis(cyclooctatetraene)nickel(0); and
- bis(1,3,7-octatriene)nickel(0).

Claim 52 (Currently Amended): The catalytic system as claimed in claim 46 97, wherein, in a nickel compound (B₂) or (B₃), a π -allyl group has from 3 to 12 carbon atoms which do not have other aliphatic unsaturated groups, except where it contains a closed cycle.

Claim 53 (Currently Amended): The catalytic system as claimed in claim 46 97, wherein the nickel compound (B₂) is selected from:

- π - allylnickel chloride;
- π - allylnickel bromide;
- π - crotylnickel chloride;
- π - methylallylnickel chloride;
- π - ethylallylnickel chloride;
- π - cyclopentylallylnickel bromide;
- π - cyclooctenylnickel chloride;
- π - cyclooctadienylnickel chloride;
- π - cinnamylnickel bromide;
- π - phenylallylnickel chloride;
- π - cyclohexenylnickel bromide;
- π - cyclododecenylnickel chloride;

π - cyclododecatrienylnickel chloride;
 π - allylnickel acetate;
 π - methylallylnickel propionate;
 π - cyclooctenylnickel octoate;
 π - cyclooctenylnickel methoxylate; and
 π - allylnickel ethoxylate.

Claim 54 (Currently Amended): The catalytic system as claimed in claim 46 97, wherein the nickel compound (B3) is selected from:

- . bis(π - allyl)nickel;
- . bis(π - methallyl)nickel;
- . bis(π - cinnamyl)nickel;
- . bis(π - octadienyl)nickel;
- . bis(π - cyclohexenyl)nickel;
- . π - allyl- π - methallylnickel; and
- . bis(π - cyclooctatrienyl)nickel.

Claim 55 (Currently Amended): The catalytic system as claimed in claim 46 97, wherein the components (A) and (B) are present in amounts such that the nickel-to-ligand(s) molar ratio is between 1 and 100.

Claim 56 (Previously Presented) The catalytic system as claimed in claim 55, wherein the components (A) and (B) are present in amounts such that the nickel-to-ligand(s) molar ratio is between 2 and 50.

Claim 57 (Cancelled)

Claim 58 (Currently Amended): The process as claimed in claim ~~57~~ 99, wherein:

- in a first step, each of the constituents (A) and (B), which are in solution in an inert solvent, are introduced separately or simultaneously into a reactor, together with the reaction mixture; and
- in a second step, the olefin or olefins are introduced, the (co)polymerization taking place at a temperature between 0 and 300°C and at a total absolute pressure of from 1 to 200 bar.

Claim 59 (Previously Presented): The process as claimed in claim 58, wherein the constituents (A) and (B) are introduced in a nickel-to-ligand(s) molar ratio of between 1 and 100.

Claim 60 (Previously Presented): The process as claimed in claim 59, wherein the constituents (A) and (B) are introduced in a nickel-to-ligand(s) molar ratio of between 2 and 50.

Claim 61 (Previously Presented): The process as claimed in claim 58, wherein the inert solvent of constituents (A) and (B) is selected from saturated aliphatic hydrocarbons, saturated alicyclic hydrocarbons, aromatic hydrocarbons and mixtures thereof.

Claim 62 (Previously Presented): The process as claimed in claim 58, wherein the reaction mixture consists of an organic medium.

Claim 63 (Previously Presented): The process as claimed in claim 58, wherein the reaction mixture comprises a continuous liquid aqueous phase, which comprises more than 30% water by weight.

Claim 64 (Previously Presented): The process as claimed in claim 63, wherein the aqueous phase is the only liquid phase.

Claim 65 (Previously Presented): The process as claimed in claim 63, wherein the mixture comprises an organic liquid phase.

Claim 66 (Previously Presented): The process as claimed in claim 62, wherein the medium or the organic phase is selected from:

- saturated aliphatic hydrocarbons, saturated alicyclic hydrocarbons, aromatic hydrocarbons and mixtures thereof; and
- to the extent that the polymerization conditions keep them in liquid form, α -olefins, unconjugated dienes and mixtures thereof.

Claim 67 (Previously Presented): The process as claimed in claim 63, wherein the polymerization medium comprises a dispersing agent.

Claim 68 (Previously Presented): The process as claimed in claim 67, wherein the dispersing agent is present at up to 10% by weight for the weight of water.

Claim 69 (Previously Presented): The process as claimed in claim 68, wherein the dispersing agent is present at 0.01 to 5% by weight for the weight of water.

Claim 70 (Previously Presented): The process as claimed in claim 63, wherein the polymerization medium comprises an emulsifying agent.

Claim 71 (Previously Presented): The process as claimed in claim 70, wherein the emulsifying agent is present at up to 10% by weight, for the weight of water.

Claim 72 (Previously Presented): The process as claimed in claim 71, wherein the emulsifying agent is present at 0.01 to 5% by weight for the weight of water.

Claim 73 (Previously Presented): The process as claimed in claim 70, wherein the emulsifying agent is present in an amount greater than the critical micelle concentration.

Claim 74 (Previously Presented): The process as claimed in claim 73, wherein the amount of emulsifying agent is enough so that the polymerization takes place mainly in the micelles.

Claim 75 (Previously Presented): The process as claimed in claim 70, wherein the polymerization medium comprises a liquid organic phase and a cosurfactant.

Claim 76 (Cancelled)

Claim 77 (Previously Presented): The process as claimed in claim 75 wherein the cosurfactant has a solubility in water of less than 1×10^{-3} mol per liter at 20°C.

Claim 78 (Previously Presented): The process as claimed in claim 75 wherein the cosurfactant is present at up to 10% by weight for the weight of water.

Claim 79 (Previously Presented): The process as claimed in claim 75 wherein the emulsifying agent to cosurfactant mass ratio goes from 0.5 to 2.

Claim 80 (Previously Presented): The process as claimed in claim 58, wherein the concentration of the constituent (A) in the inert solvent is between 0.1 micromol and 100 millimol per liter of solution.

Claim 81 (Previously Presented): The process as claimed in claim 58, wherein the concentration of the constituent (B) in the inert solvent is between 0.1 micromol and 200 millimol per liter of solution.

Claim 82 (Previously Presented): The process as claimed in claim 58, wherein it is carried out in an inert atmosphere.

Claim 83 (Previously Presented): The process as claimed in claim 58, wherein, in a preliminary step, the constituents (A) and (B) in solution are brought into contact with each other in their inert solvent, for a duration of 30 seconds to 10 minutes, before their introduction into the reaction mixture, this precontacting step being carried out in an inert atmosphere, at a temperature of between 0 and 100°C.

Claim 84 (Previously Presented): The process as claimed in claim 83, wherein this precontacting step is carried out at a temperature between 10 and 70°C.

Claim 85 (Previously Presented): The process as claimed in claim 58, wherein the constituents (A) and (B), which are in solution in their inert solvent, are introduced separately into the reaction mixture, the latter being held at a temperature of from 0 to 100° C.

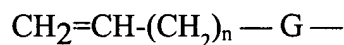
Claim 86 (Previously Presented): The process as claimed in claim 85, wherein the reaction mixture is held at a temperature from 10 to 70°C.

Claim 87 (Previously Presented): The process as claimed in claim 58, wherein the (co)polymerization is carried out at a temperature of between 25 and 200°C.

Claim 88 (Previously Presented): The process as claimed in claim 58, wherein the (co)polymerization is carried out at a total absolute pressure of from 1 to 100 bar.

Claim 89 (Previously Presented): The process as claimed in claim 58, wherein the olefin or olefins intended to be polymerized are introduced in gas or liquid form, with enough stirring of the polymerization medium.

Claim 90 (Previously Presented): The process according to claim 58, characterized in that the olefins are chosen from ethylene, α -olefins, cyclic olefins and compounds of formula:



in which:

- n is an integer between 2 and 20; and
- G is a radical chosen from:
 - OH; CHOHCH_2OH ; OT; $-\text{CF}_3$; $-\text{COOT}$; $-\text{COOH}$;
 - $\text{Si}(\text{OH})_3$; $-\text{Si}(\text{OT})_3$;

T is a hydrocarbon radical having from 1 to 20 carbon atoms.

Claim 91 (Previously Presented): The process as claimed in claim 58, wherein at least one olefin is ethylene.

Claim 92 (Previously Presented): The process as claimed in claim 70, wherein the polymerization is carried out in the presence of an emulsifying agent, leading therefore to a latex, if necessary after a filtration step.

Claim 93 (Previously Presented): The process as claimed in claim 92, wherein the latex is a high-density polyethylene or a medium-density polyethylene or a low-density polyethylene.

Claim 94 (Previously Presented): The process as claimed in claim 71, wherein the emulsifying agent is present at up to 0.01 to 5% by weight, for the weight of water.

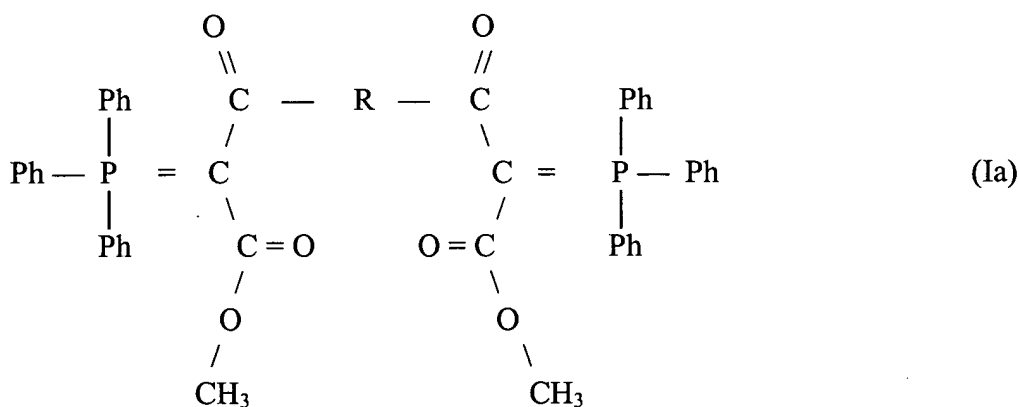
Claim 95 (Cancelled)

Claim 96 (Cancelled)

Claim 97 (New): A catalytic system for the polymerization of at least one olefin in a diluting medium in the presence of the catalytic system, the catalytic system being formed *in situ* from:

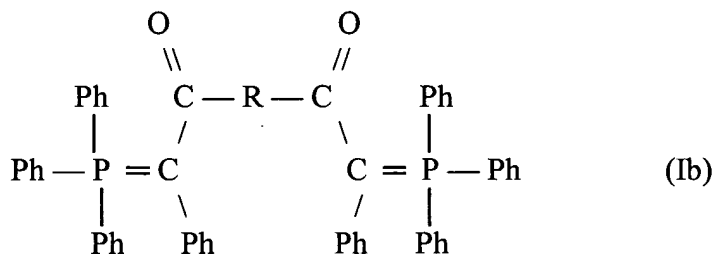
(A) at least one ligand selected from the group consisting of:

a ligand represented by formula (Ia):



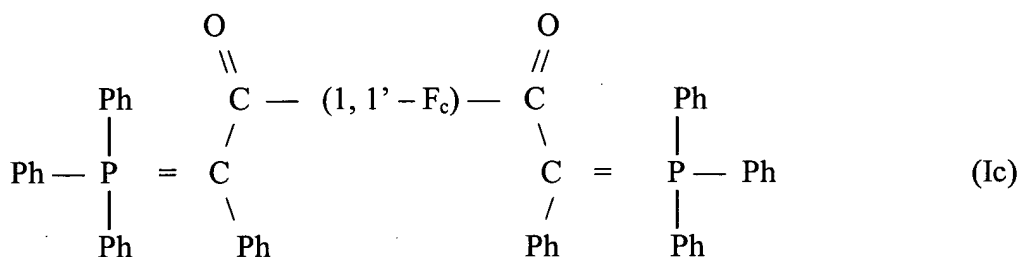
where R represents a 5,6-bicyclo[2.2.1]hept-2-ene radical; $-(\text{CH}_2)_4-$ or $-(\text{CH}_2)_8-$;

a ligand represented by formula (Ib):



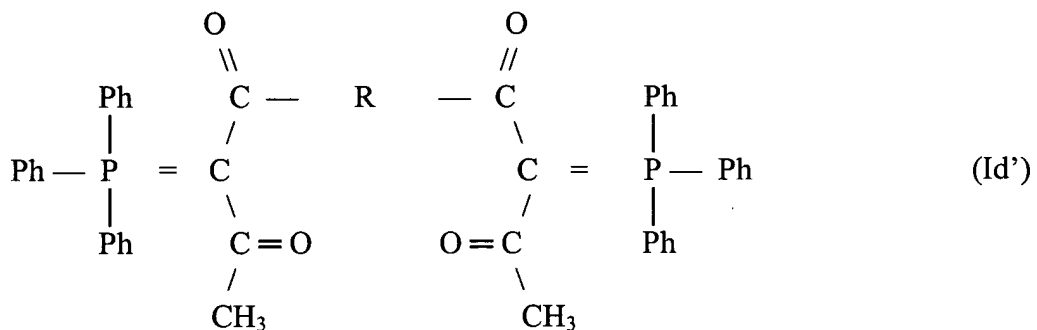
wherein R represents a 5,6-bicyclo[2.2.2]-hept-2-ene radical or $-(\text{CH}_2)_8-$;

a ligand represented by formula (Ic):



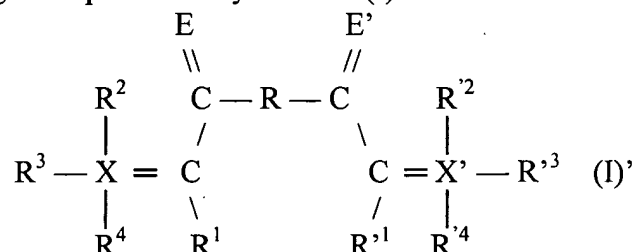
where $1, 1' - \text{Fc}$ represents a-1,1'-ferrocenylene radical;

a ligand represented by formula (Id'):



where R represents a phenyl radical of the formula $1,4-\text{C}_6\text{H}_4$; and

a ligand represented by formula (I)':



where:

- E and E' each represent independently an oxygen or a sulfur atom;
- X and X' each represent independently a phosphorus, arsenic or antimony atom;
- the radicals R¹ and R'¹, which are identical or different, are selected from the

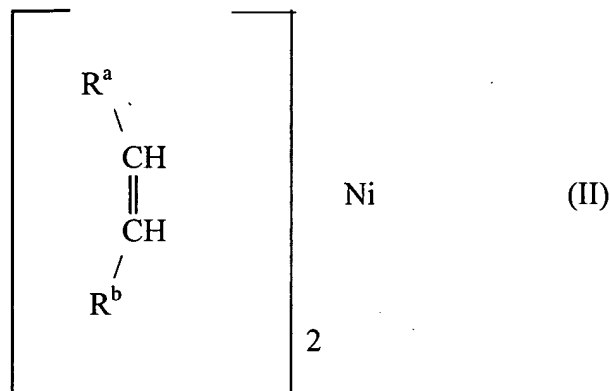
group consisting of:

- * branched or cyclic alkyl radicals;
- * arylalkyl radicals;
- * alkylaryl radicals;
- * halogens;
- * hydroxyl radical; and
- * alkoxide radicals;

- the R², R'², R³, R'³, R⁴ and R'⁴ radicals, which are identical or different, are selected from the group consisting of linear, branched or cyclic alkyl radicals; and
- R is a divalent radical; and

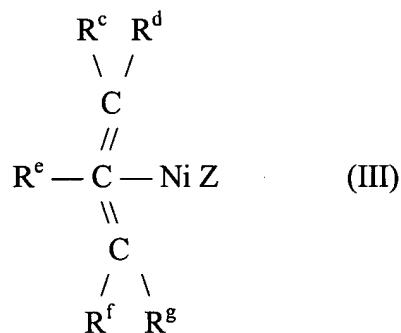
(B) at least one nickel compound selected from:

(B1) nickel complexes with a zero oxidation state, which are represented by the general formula (II):



where R^a and R^b each represent independently a hydrogen atom, or a linear, branched or cyclic alkyl radical or aryl, arylalkyl or alkylaryl radical, which have up to 8 carbon atoms, it being also possible for R^a and R^b to form together a divalent aliphatic group of 2 to 10 carbon atoms and have up to three olefinic double bonds as the only carbon-carbon unsaturated groups;

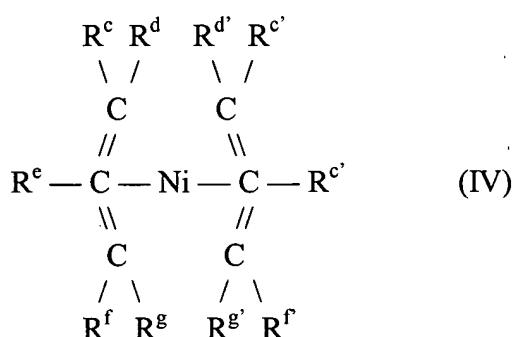
(B2) π -allylnickels, which are represented by the formula (III):



in which:

- the R^c , R^d , R^e , R^f and R^g radicals, which are identical or different, are selected from hydrogen, linear, branched or cyclic alkyl radicals and aryl, arylalkyl or alkylaryl radicals, having up to 8 carbon atoms;
- the dotted lines represent the electron delocalization on the three contiguous carbon atoms;

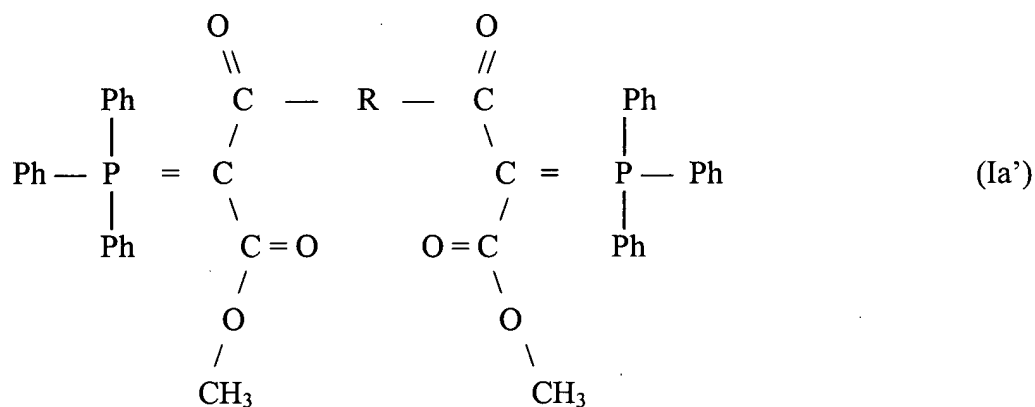
- an R^c or R^d radical may also form, with an R^e or R^f or R^g radical, a divalent alkene group having from 2 to 10 carbon atoms and able to have up to three olefinic double bonds; and
 - Z represents a halogen, an alkoxy group or an alkanoyloxy group;
- (B3) compounds of the bis(allyl)nickel type which are represented by the (IV):



in which:

- the radicals R^c to R^g , and $R^{c'}$ to $R^{g'}$, which are identical or different, are selected from hydrogen, linear, branched or cyclic alkyl radicals and aryl, arylalkyl or alkylaryl radicals having up to 8 carbon atoms;
- the dotted lines represent the electron delocalization on the three contiguous carbon atoms;
- a radical R^c or R^d also able to form, with a radical R^e or R^f or R^g , a divalent alkene group having from 2 to 10 carbon atoms and able to have up to three olefinic double bonds;
- a radical $R^{c'}$ or $R^{d'}$ also able to form, with a radical $R^{e'}$ or $R^{f'}$ or $R^{g'}$, a divalent alkene group having from 2 to 10 carbon atoms and able to have up to three olefinic double bonds.

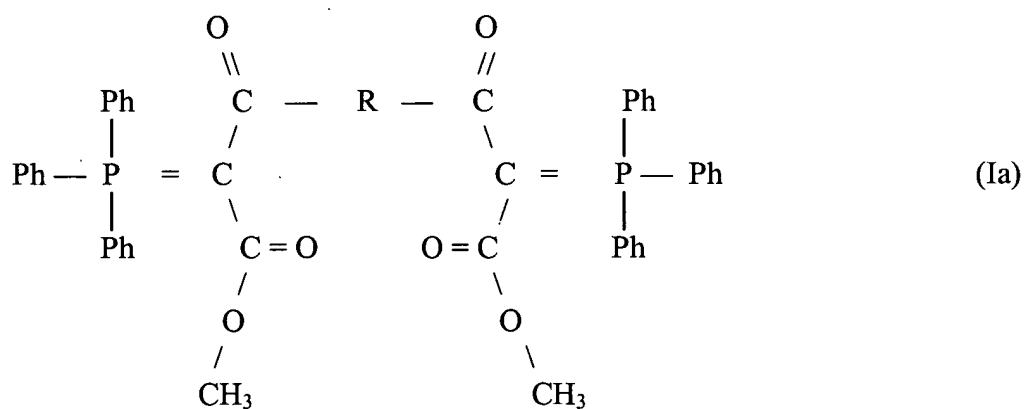
Claim 98 (New): The catalytic system of claim 97, wherein the at least one ligand (A) is a ligand represented by formula (Ia'):



where R represents a 5,6-bicyclo[2.2.1]hept-2-ene radical.

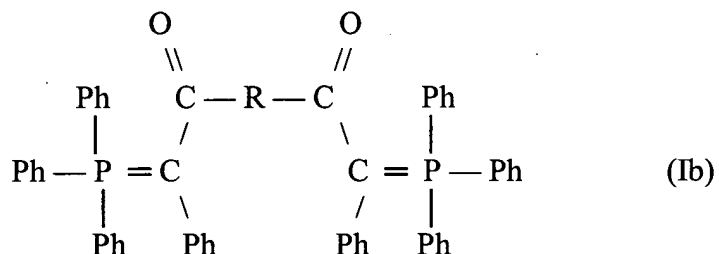
Claim 99 (New): A process for the polymerization of at least one olefin in a diluting medium in the presence of a catalytic system, the catalytic system being formed *in situ* from:

(A) at least one ligand selected from the group consisting of:
a ligand represented by formula (Ia):

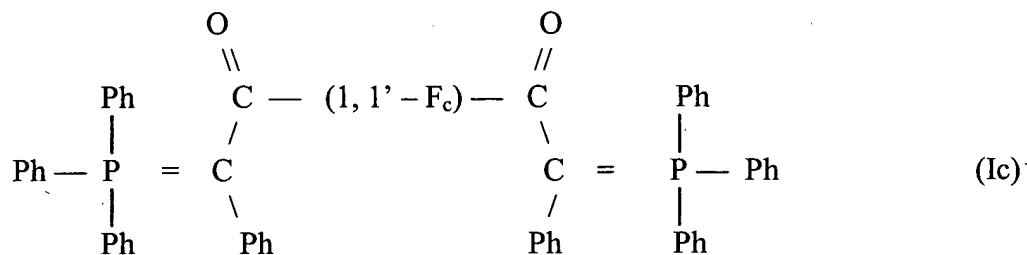


where R represents a 5,6-bicyclo[2.2.1]hept-2-ene radical; $-(\text{CH}_2)_4-$ or $-(\text{CH}_2)_8-$;

a ligand represented by formula (Ib):

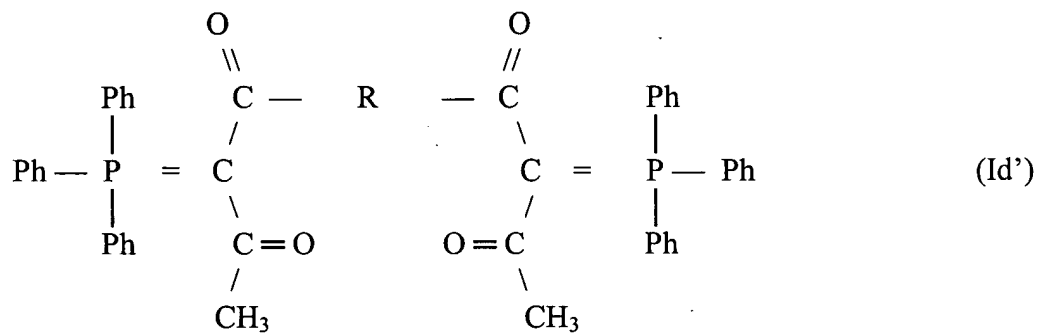


a ligand represented by formula (Ic):



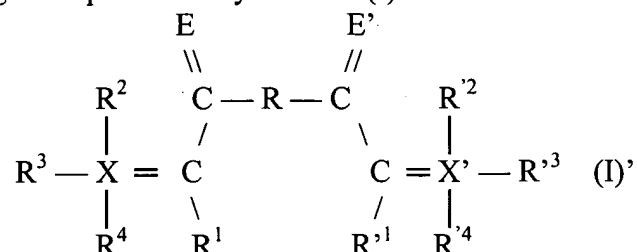
where 1,1'-Fc represents a-1,1'-ferrocenylene radical; and

a ligand represented by formula (Id'):



where R represents a phenyl radical of the formula 1,4-C₆H₄; and

a ligand represented by formula (I)':



where:

- E and E' each represent independently an oxygen or a sulfur atom;
- X and X' each represent independently a phosphorus, arsenic or antimony atom;
- the radicals R^1 and R'^1 , which are identical or different, are selected from the

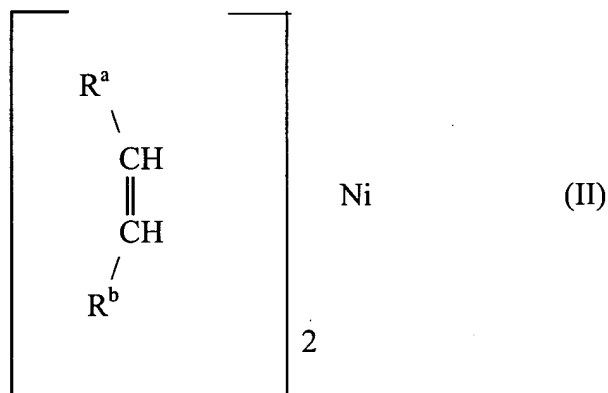
group consisting of:

- * branched or cyclic alkyl radicals;
- * arylalkyl radicals;
- * alkylaryl radicals;
- * halogens;
- * hydroxyl radical; and
- * alkoxide radicals;

- the R^2 , R'^2 , R^3 , R'^3 , R^4 and R'^4 radicals, which are identical or different, are selected from the group consisting of linear, branched or cyclic alkyl radicals; and
- R is a divalent radical; and

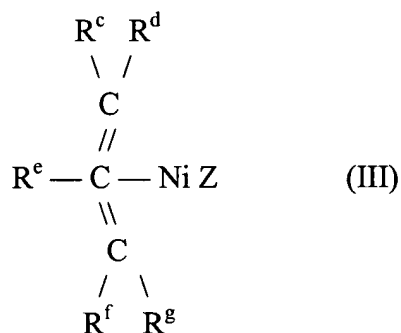
(B) at least one nickel compound selected from:

(B1) nickel complexes with a zero oxidation state, which are represented by the general formula (II):



where R^a and R^b each represent independently a hydrogen atom, or a linear, branched or cyclic alkyl radical or aryl, arylalkyl or alkylaryl radical, which have up to 8 carbon atoms, it being also possible for R^a and R^b to form together a divalent aliphatic group of 2 to 10 carbon atoms and have up to three olefinic double bonds as the only carbon-carbon unsaturated groups;

(B2) π -allylnickels, which are represented by the formula (III):

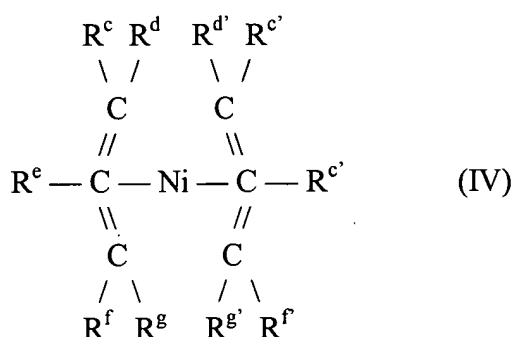


in which:

- the R^c , R^d , R^e , R^f and R^g radicals, which are identical or different, are selected from hydrogen, linear, branched or cyclic alkyl radicals and aryl, arylalkyl or alkylaryl radicals, having up to 8 carbon atoms;
- the dotted lines represent the electron delocalization on the three contiguous carbon atoms;

- an R^c or R^d radical may also form, with an R^e or R^f or R^g radical, a divalent alkene group having from 2 to 10 carbon atoms and able to have up to three olefinic double bonds; and
- Z represents a halogen, an alkoxy group or an alkanoyloxy group;

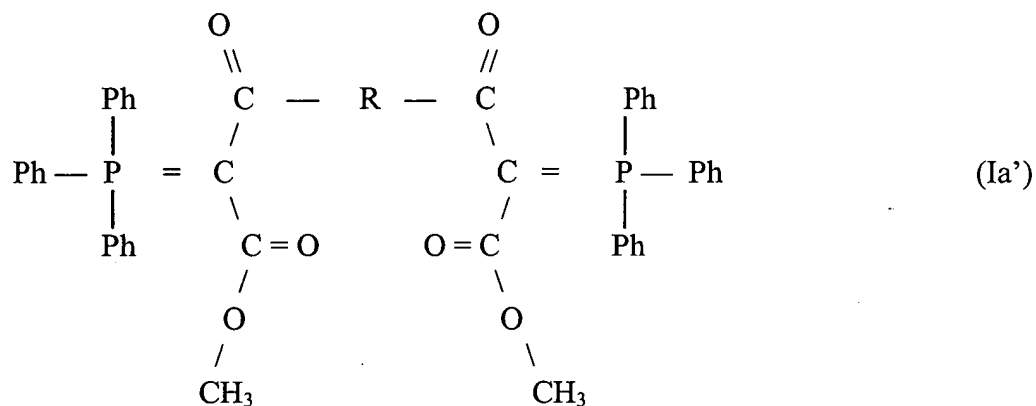
(B3) compounds of the bis(allyl)nickel type which are represented by the (IV):



in which:

- the radicals R^c to R^g , and $R^{c'}$ to $R^{g'}$, which are identical or different, are selected from hydrogen, linear, branched or cyclic alkyl radicals and aryl, arylalkyl or alkylaryl radicals having up to 8 carbon atoms;
- the dotted lines represent the electron delocalization on the three contiguous carbon atoms;
- a radical R^c or R^d also able to form, with a radical R^e or R^f or R^g , a divalent alkene group having from 2 to 10 carbon atoms and able to have up to three olefinic double bonds;
- a radical $R^{c'}$ or $R^{d'}$ also able to form, with a radical $R^{e'}$ or $R^{f'}$ or $R^{g'}$, a divalent alkene group having from 2 to 10 carbon atoms and able to have up to three olefinic double bonds.

Claim 100 (New): The process according to claim 99, wherein in the catalytic system, the at least one ligand (A) is a ligand represented by formula (Ia'):



where R represents a 5,6-bicyclo[2.2.1]hept-2-ene radical.